



RF Power Field Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

Designed for Class A or Class AB general purpose applications with frequencies from 1600 to 2200 MHz. Suitable for analog and digital modulation and multipurpose amplifier applications.

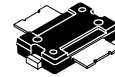
- Typical Two-Tone Performance @ 2170 MHz: $V_{DD} = 28$ Volts, $I_{DQ} = 130$ mA, $P_{out} = 10$ Watts PEP
 Power Gain — 15.5 dB
 Drain Efficiency — 36%
 IMD — -34 dBc
- Typical 2-Carrier W-CDMA Performance: $V_{DD} = 28$ Volts, $I_{DQ} = 130$ mA, $P_{out} = 1$ Watt Avg., Full Frequency Band (2130-2170 MHz), Channel Bandwidth = 3.84 MHz. PAR = 8.5 dB @ 0.01% Probability
 Power Gain — 15.5 dB
 Drain Efficiency — 15%
 IM3 @ 10 MHz Offset — -47 dBc in 3.84 MHz Channel Bandwidth
 ACPR @ 5 MHz Offset — -49 dBc in 3.84 MHz Channel Bandwidth
- Typical Single-Carrier N-CDMA Performance: $V_{DD} = 28$ Volts, $I_{DQ} = 130$ mA, $P_{out} = 1$ Watt Avg., Full Frequency Band (1930-1990 MHz), IS-95 (Pilot, Sync, Paging, Traffic Codes 8 through 13), Channel Bandwidth = 1.2288 MHz. PAR = 9.8 dB @ 0.01% Probability on CCDF.
 Power Gain — 15.5 dB
 Drain Efficiency — 16%
 ACPR @ 885 kHz Offset = -60 dBc in 30 kHz Bandwidth
- Typical GSM EDGE Performance: $V_{DD} = 28$ Volts, $I_{DQ} = 130$ mA, $P_{out} = 4$ Watts Avg., Full Frequency Band (1805-1880 MHz)
 Power Gain — 16 dB
 Drain Efficiency — 33%
 EVM — 1.3% rms
- Capable of Handling 5:1 VSWR, @ 28 Vdc, 2000 MHz, 10 Watts CW Output Power

Features

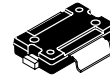
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Internally Matched for Ease of Use
- Qualified Up to a Maximum of 32 V_{DD} Operation
- Integrated ESD Protection
- 200°C Capable Plastic Package
- RoHS Compliant
- In Tape and Reel. R1 Suffix = 500 Units per 24 mm, 13 inch Reel.

MRF6S20010NR1
MRF6S20010GNR1

1600-2200 MHz, 10 W, 28 V
GSM/GSM EDGE
SINGLE N-CDMA
2 x W-CDMA
LATERAL N-CHANNEL
RF POWER MOSFETs



CASE 1265-08, STYLE 1
TO-270-2
PLASTIC
MRF6S20010NR1



CASE 1265A-02, STYLE 1
TO-270-2 GULL
PLASTIC
MRF6S20010GNR1

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +68	Vdc
Gate-Source Voltage	V_{GS}	-0.5, +12	Vdc
Storage Temperature Range	T_{stg}	-65 to +175	°C
Operating Junction Temperature	T_J	200	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value (1,2)	Unit
Thermal Resistance, Junction to Case Case Temperature 78°C, 1 W CW Case Temperature 79°C, 10 W PEP, Two-Tone Test	$R_{\theta JC}$	2.5 5.9	°C/W

Table 3. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JESD22-A114)	1A (Minimum)
Machine Model (per EIA/JESD22-A115)	A (Minimum)
Charge Device Model (per JESD22-C101)	IV (Minimum)

Table 4. Moisture Sensitivity Level

Test Methodology	Rating	Package Peak Temperature	Unit
Per JESD 22-A113, IPC/JEDEC J-STD-020	3	260	°C

Table 5. Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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Off Characteristics

Zero Gate Voltage Drain Leakage Current ($V_{DS} = 68\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$)	I_{DSS}	—	—	10	μAdc
Zero Gate Voltage Drain Leakage Current ($V_{DS} = 28\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$)	I_{DSS}	—	—	1	μAdc
Gate-Source Leakage Current ($V_{GS} = 5\text{ Vdc}$, $V_{DS} = 0\text{ Vdc}$)	I_{GSS}	—	—	500	μAdc

On Characteristics

Gate Threshold Voltage ($V_{DS} = 10\text{ Vdc}$, $I_D = 40\ \mu\text{Adc}$)	$V_{GS(th)}$	1.5	2.2	3.5	Vdc
Gate Quiescent Voltage ($V_{DS} = 28\text{ Vdc}$, $I_D = 130\text{ mAdc}$, Measured in Functional Test)	$V_{GS(Q)}$	2	2.8	4	Vdc
Drain-Source On-Voltage ($V_{GS} = 10\text{ Vdc}$, $I_D = 0.4\text{ Adc}$)	$V_{DS(on)}$	—	0.33	0.4	Vdc

Dynamic Characteristics⁽³⁾

Input Capacitance ($V_{DS} = 28\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$)	C_{iss}	—	0.12	—	pF
Output Capacitance ($V_{DS} = 28\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$)	C_{oss}	—	0.02	—	pF
Reverse Transfer Capacitance ($V_{DS} = 28\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$)	C_{rss}	—	11.6	—	pF

Functional Tests (In Freescale Test Fixture, 50 ohm system) $V_{DD} = 28\text{ Vdc}$, $I_{DQ} = 130\text{ mA}$, $P_{out} = 10\text{ W PEP}$, $f_1 = 2170\text{ MHz}$, $f_2 = 2170.1\text{ MHz}$, Two-Tone Test

Power Gain	G_{ps}	14	15.5	17	dB
Drain Efficiency	η_D	33	36	—	%
Intermodulation Distortion	IMD	—	-34	-28	dBc
Input Return Loss	IRL	—	-15	-9	dB

1. MTTF calculator available at <http://www.freescale.com/rf>. Select Tools/Software/Application Software/Calculators to access the MTTF calculators by product.
2. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers*. Go to <http://www.freescale.com/rf>. Select Documentation/Application Notes - AN1955.
3. Part internally matched on input.

(continued)

Table 5. Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise noted) (continued)

Characteristic	Symbol	Min	Typ	Max	Unit
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Typical 2-Carrier W-CDMA Performances (In Freescale CDMA Test Fixture, 50 ohm system) $V_{DD} = 28\text{ Vdc}$, $I_{DQ} = 130\text{ mA}$, $P_{out} = 1\text{ W Avg.}$, $f_1 = 2112.5\text{ MHz}$, $f_2 = 2122.5\text{ MHz}$ and $f_1 = 2157.5\text{ MHz}$, $f_2 = 2167.5\text{ MHz}$, 2-Carrier W-CDMA, 3.84 MHz Channel Bandwidth Carriers. ACPR measured in 3.84 MHz Channel Bandwidth @ $\pm 5\text{ MHz}$ Offset. IM3 measured in 3.84 MHz Bandwidth @ $\pm 10\text{ MHz}$ Offset. PAR = 8.5 dB @ 0.01% Probability on CCDF.

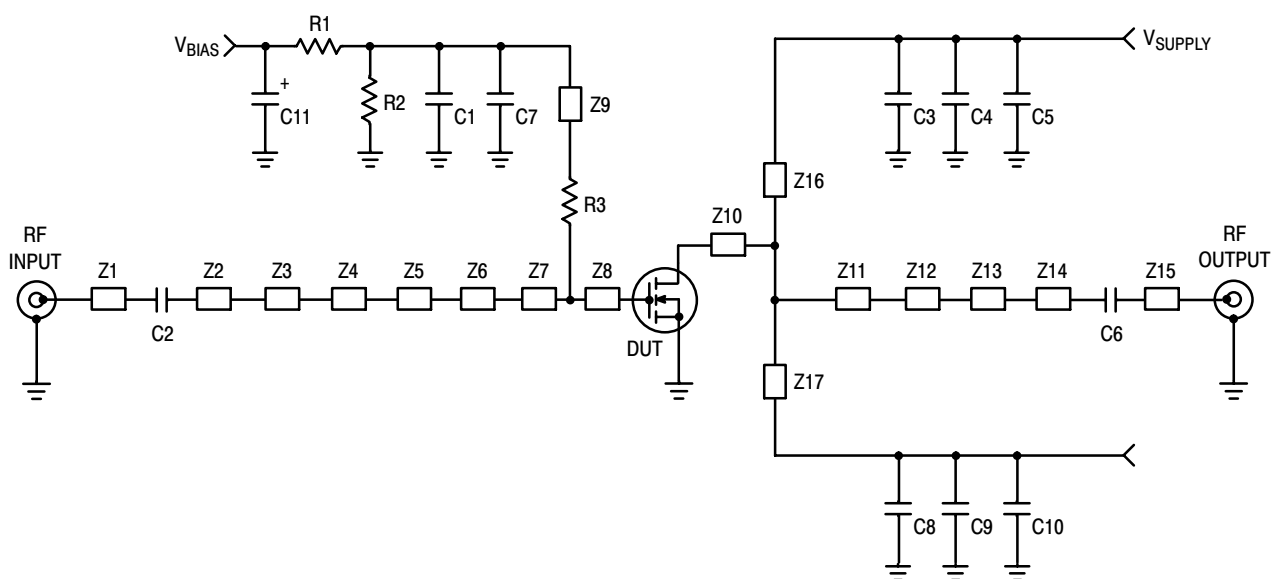
Power Gain	G_{ps}	—	15.5	—	dB
Drain Efficiency	η_D	—	15	—	%
Gain Flatness in 30 MHz Bandwidth @ $P_{out} = 1\text{ W CW}$	G_F	—	0.3	—	dB
Intermodulation Distortion	IM3	—	-47	—	dBc
Adjacent Channel Power Ratio	ACPR	—	-49	—	dBc

Typical N-CDMA Performances (In Freescale Test Fixture, 50 ohm system) $V_{DD} = 28\text{ Vdc}$, $I_{DQ} = 130\text{ mA}$, $P_{out} = 1\text{ W Avg.}$, 1930 MHz < Frequency < 1990 MHz, Single-Carrier N-CDMA, 1.2288 MHz Channel Bandwidth Carrier. ACPR measured in 30 kHz Channel Bandwidth @ $\pm 885\text{ kHz}$ Offset. PAR = 9.8 dB @ 0.01% Probability on CCDF

Power Gain	G_{ps}	—	15.5	—	dB
Drain Efficiency	η_D	—	16	—	%
Gain Flatness in 30 MHz Bandwidth @ $P_{out} = 1\text{ W CW}$	G_F	—	0.3	—	dB
Adjacent Channel Power Ratio	ACPR	—	-60	—	dBc

Typical GSM EDGE Performances (In Freescale GSM EDGE Test Fixture, 50 ohm system) $V_{DD} = 28\text{ Vdc}$, $I_{DQ} = 130\text{ mA}$, $P_{out} = 4\text{ W Avg.}$, 1805-1880 MHz, EDGE Modulation

Power Gain	G_{ps}	—	16	—	dB
Drain Efficiency	η_D	—	33	—	%
Gain Flatness in 30 MHz Bandwidth @ $P_{out} = 4\text{ W CW}$	G_F	—	0.3	—	dB
Error Vector Magnitude	EVM	—	1.3	—	% rms
Spectral Regrowth at 400 kHz Offset	SR1	—	-60	—	dBc
Spectral Regrowth at 600 kHz Offset	SR2	—	-70	—	dBc



Z1, Z15	0.066" x 0.480" Microstrip	Z10	0.930" x 0.350" Microstrip
Z2	0.066" x 0.765" Microstrip	Z11	0.930" x 0.400" Microstrip
Z3, Z5	0.066" x 0.340" x 0.050" Taper	Z12	0.050" x 0.105" Microstrip
Z4	0.340" x 0.295" Microstrip	Z13	0.405" x 0.242" Microstrip
Z6	0.020" x 0.060" Microstrip	Z14	0.066" x 0.740" Microstrip
Z7	0.0905" x 0.280" Microstrip	Z16, Z17	0.050" x 1.250" Microstrip
Z8	0.0905" x 0.330" Microstrip	PCB	Taconic RF-35, 0.030", $\epsilon_r = 3.5$
Z9	0.050" x 0.980" Microstrip		

Figure 1. MRF6S20010NR1(GNR1) Test Circuit Schematic — 2110-2170 MHz

Table 6. MRF6S20010NR1(GNR1) Test Circuit Component Designations and Values — 2110-2170 MHz

Part	Description	Part Number	Manufacturer
C1	100 nF Chip Capacitor (1206)	CDR33BX104AKWS	Kemet
C2, C6	4.7 pF 600B Chip Capacitors	600B4R7CW	ATC
C3, C7, C8	9.1 pF 600B Chip Capacitors	600B9R1CW	ATC
C4, C5, C9, C10	10 μ F, 50 V Chip Capacitors	GRM55DR61H106KA88B	Murata
C11	10 μ F, 35 V Tantalum Chip Capacitor	T490D106K035AS	Kemet
R1	1 k Ω Chip Resistor (1206)		
R2	10 k Ω Chip Resistor (1206)		
R3	10 Ω Chip Resistor (1206)		

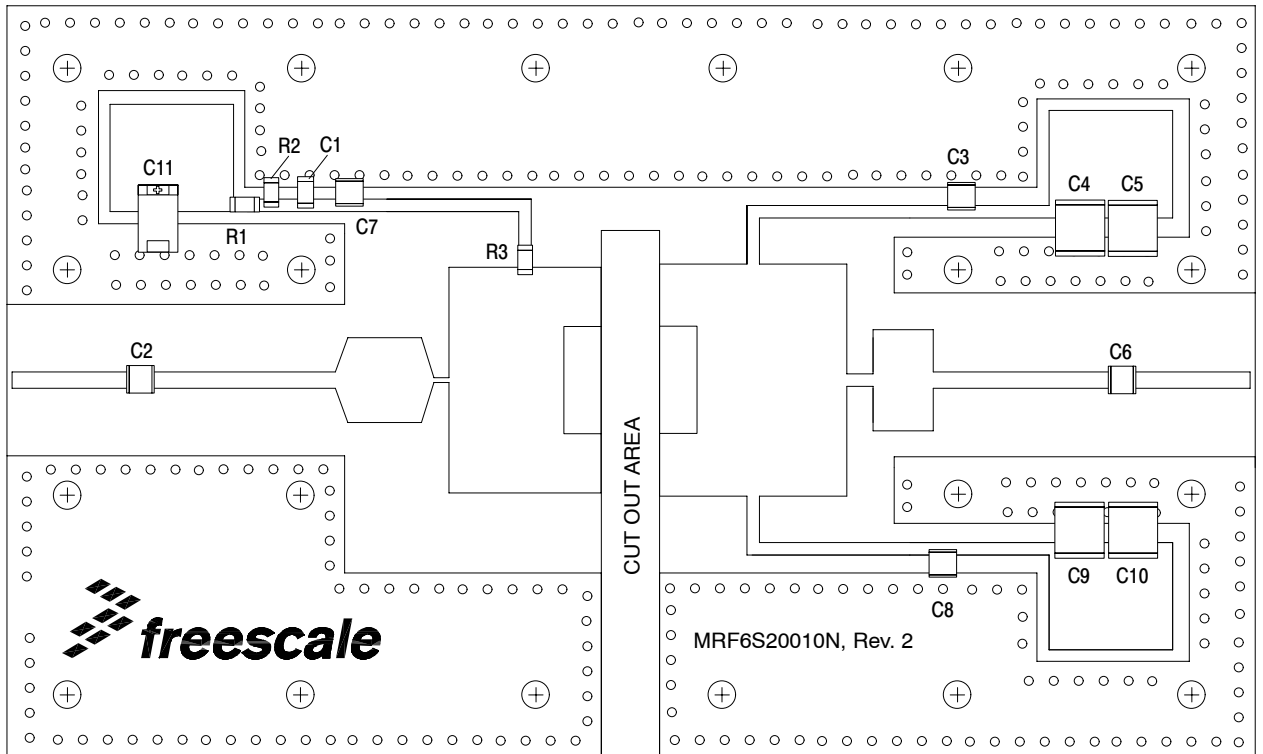
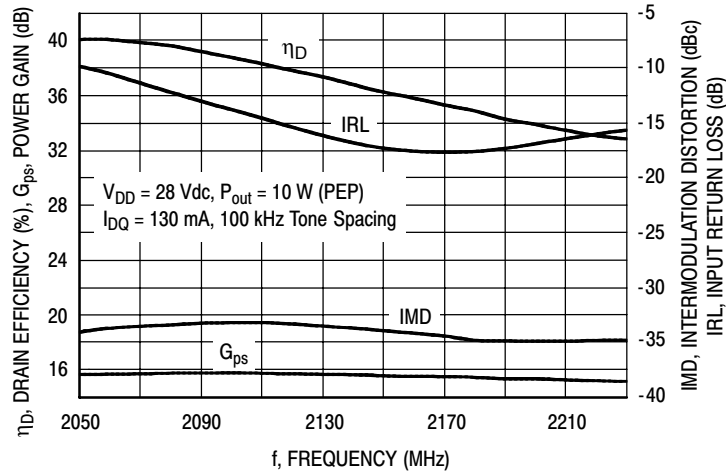
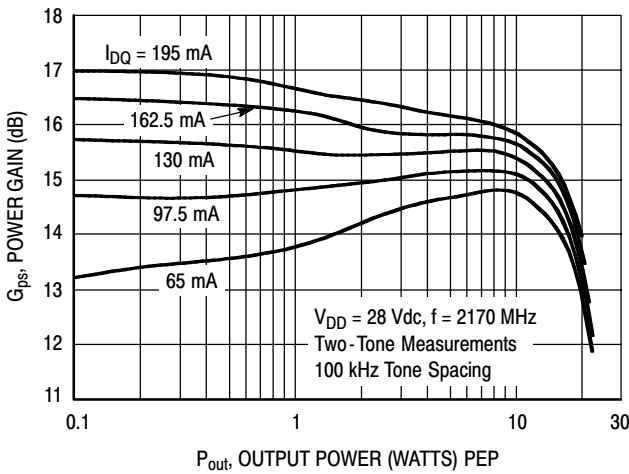


Figure 2. MRF6S20010NR1(GNR1) Test Circuit Component Layout — 2110-2170 MHz

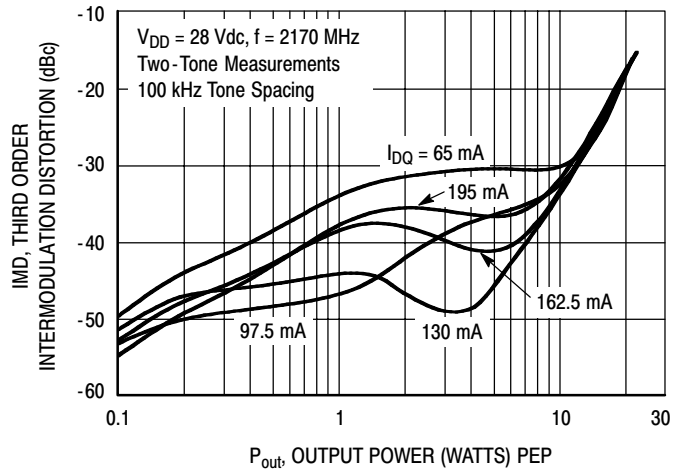
TYPICAL CHARACTERISTICS — 2110-2170 MHz



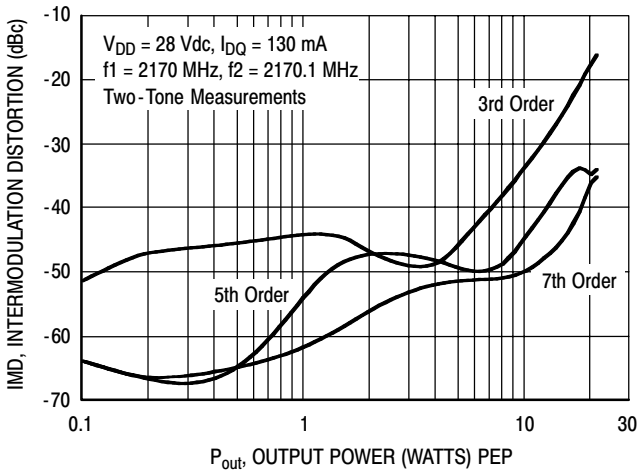
**Figure 3. Two-Tone Wideband Performance
@ P_{out} = 10 Watts (PEP)**



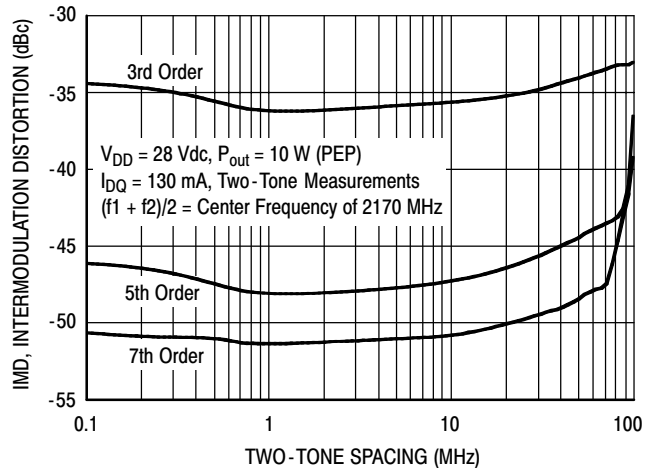
**Figure 4. Two-Tone Power Gain versus
Output Power**



**Figure 5. Third Order Intermodulation
Distortion versus Output Power**



**Figure 6. Intermodulation Distortion Products
versus Output Power**



**Figure 7. Intermodulation Distortion Products
versus Tone Spacing**

TYPICAL CHARACTERISTICS — 2110-2170 MHz

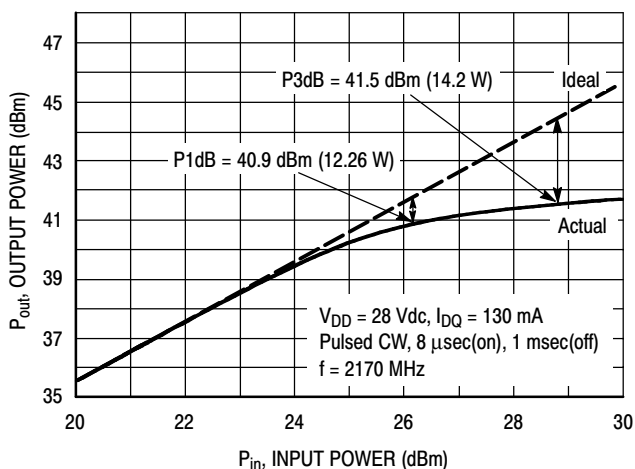


Figure 8. Pulse CW Output Power versus Input Power

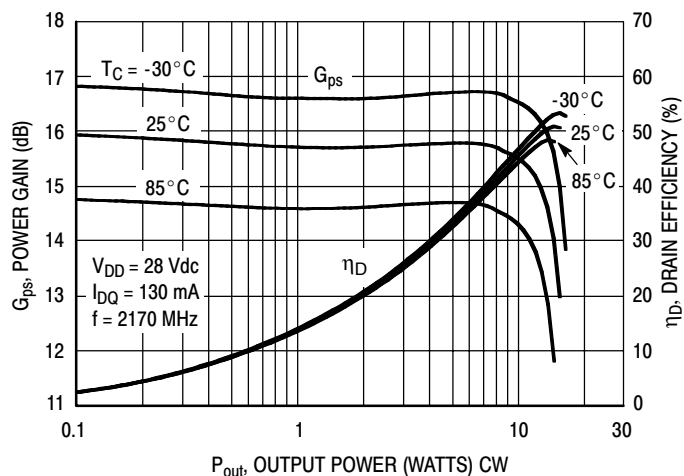


Figure 9. Power Gain and Drain Efficiency versus CW Output Power

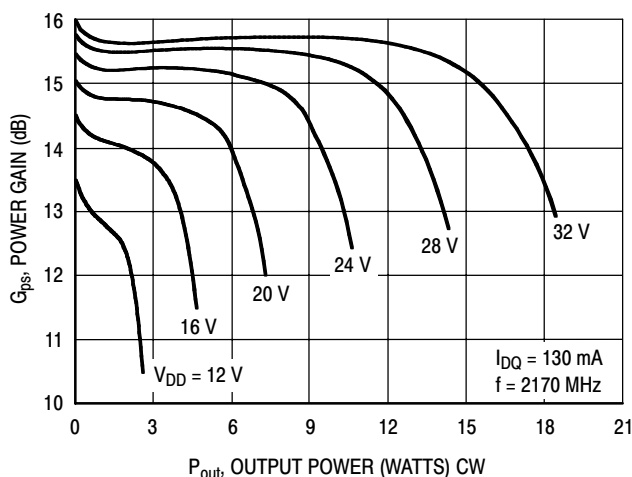


Figure 10. Power Gain versus Output Power

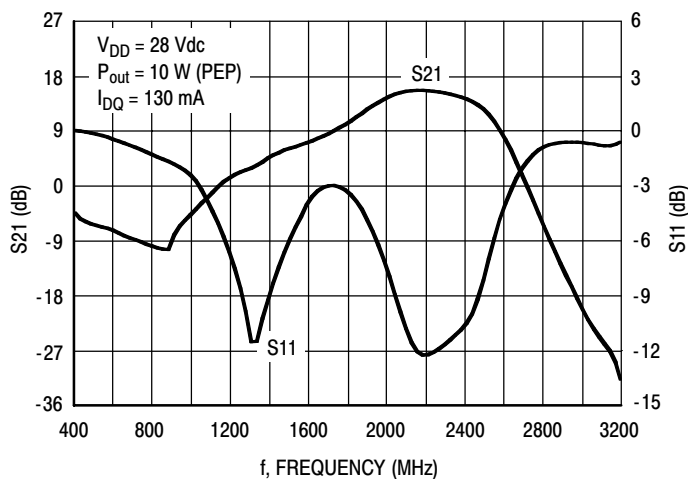
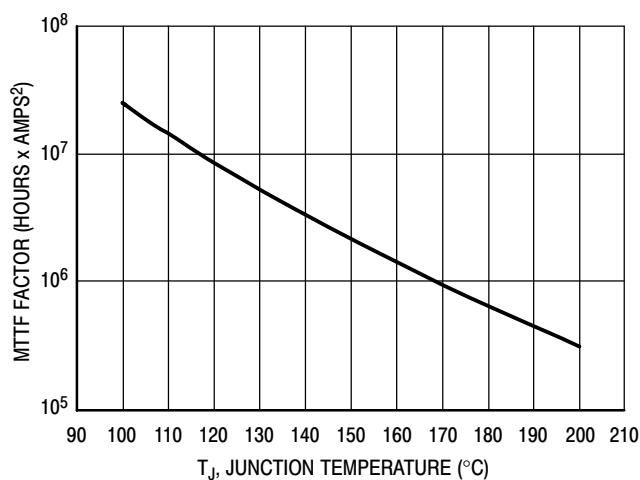


Figure 11. Broadband Frequency Response



This above graph displays calculated MTF in hours x ampere² drain current. Life tests at elevated temperatures have correlated to better than ±10% of the theoretical prediction for metal failure. Divide MTF factor by I_D^2 for MTF in a particular application.

Figure 12. MTF Factor versus Junction Temperature

MRF6S20010NR1 MRF6S20010GNR1

W-CDMA TYPICAL CHARACTERISTICS — 2110-2170 MHz

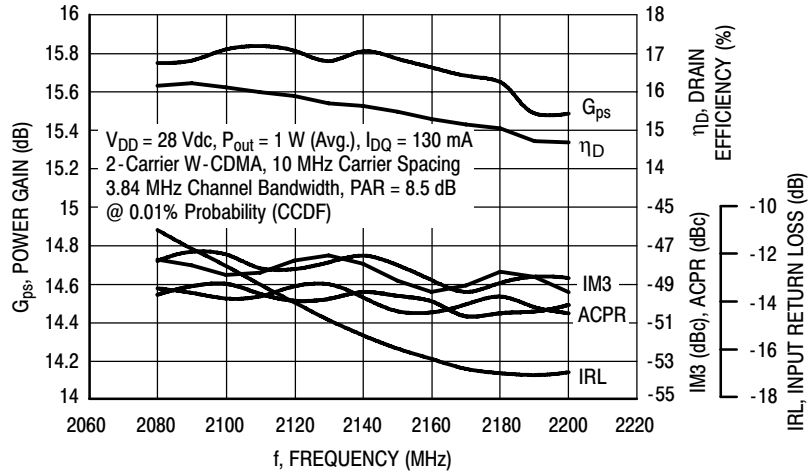


Figure 13. 2-Carrier W-CDMA Broadband Performance @ $P_{out} = 1$ Watt Avg.

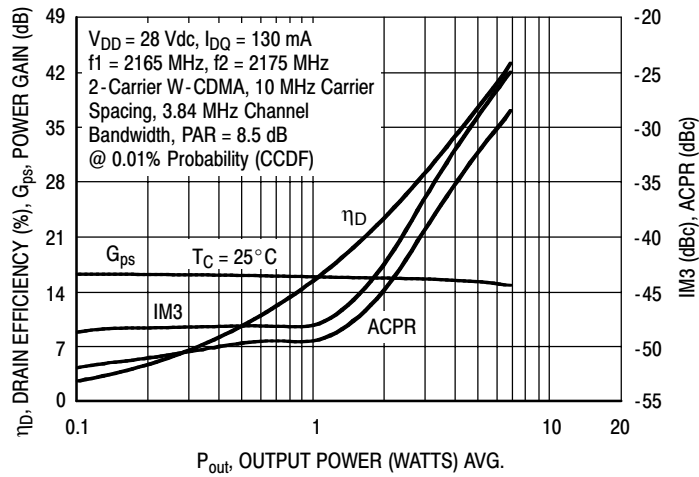


Figure 14. 2-Carrier W-CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

W-CDMA TEST SIGNAL

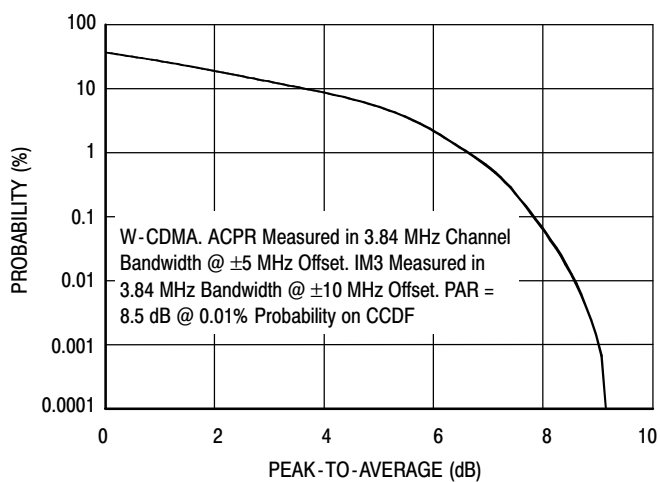


Figure 15. CCDF W-CDMA 3GPP, Test Model 1, 64 DPCH, 67% Clipping, Single-Carrier Test Signal

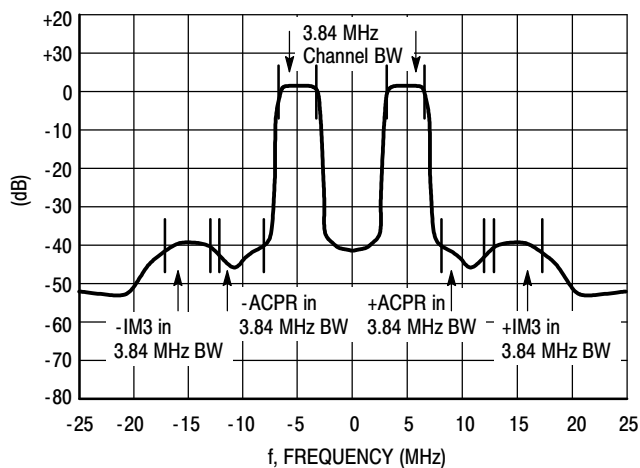


Figure 16. 2-Carrier W-CDMA Spectrum

N-CDMA TYPICAL CHARACTERISTICS — 1930-1990 MHz

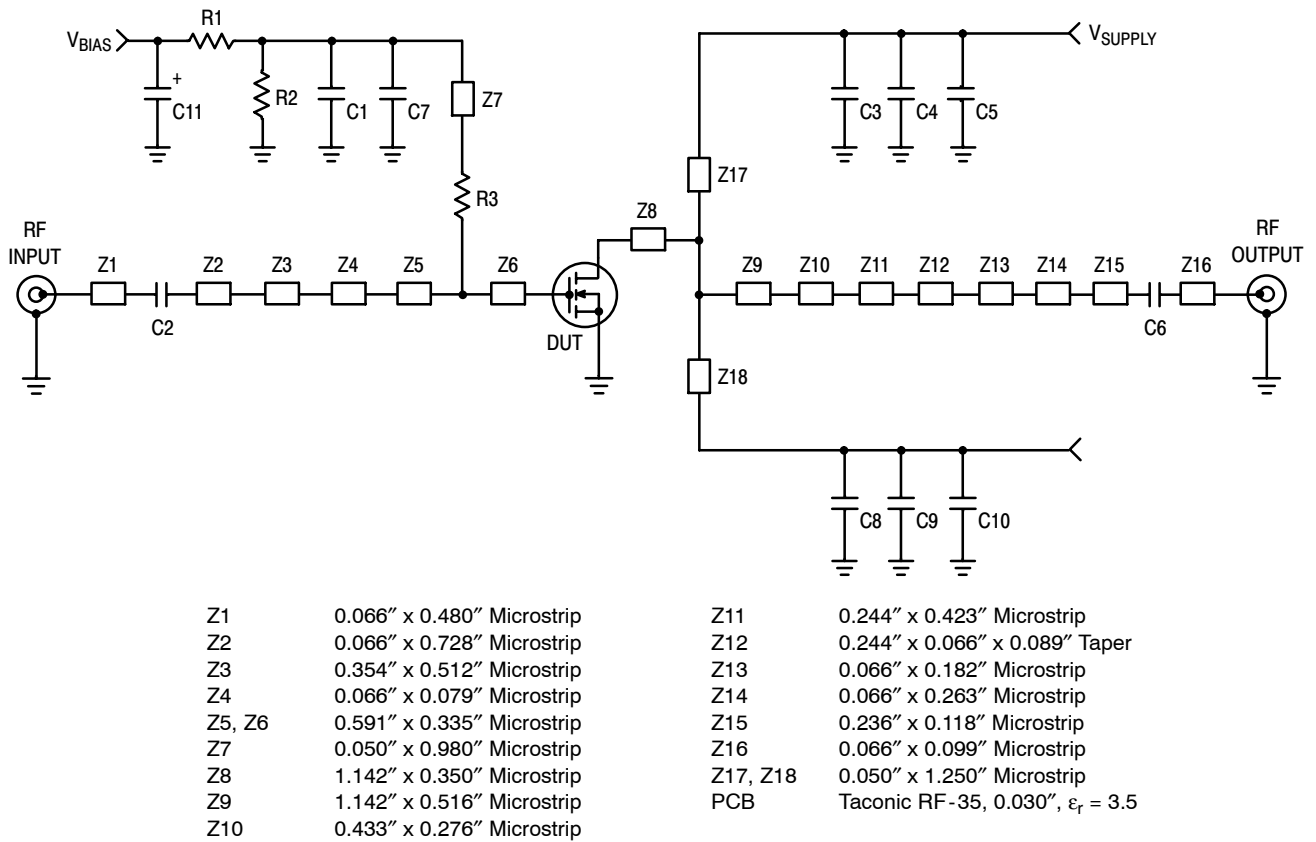


Figure 17. MRF6S20010NR1(GNR1) Test Circuit Schematic — 1930-1990 MHz

Table 7. MRF6S20010NR1(GNR1) Test Circuit Component Designations and Values — 1930-1990 MHz

Part	Description	Part Number	Manufacturer
C1	100 nF Chip Capacitor (1206)	1206C104KAT	AVX
C2, C6	4.7 pF 600B Chip Capacitors	600B4R7BW	ATC
C3, C7, C8	9.1 pF 600B Chip Capacitors	600B9R1BW	ATC
C4, C5, C9, C10	10 μ F Chip Capacitors (2220)	C5750X5R1H106MT	TDK
C11	10 μ F, 35 V Tantalum Chip Capacitor	TAJD106K035	AVX
R1, R2	10 k Ω Chip Resistors (1206)		
R3	10 Ω Chip Resistor (1206)		

N-CDMA TYPICAL CHARACTERISTICS — 1930-1990 MHz

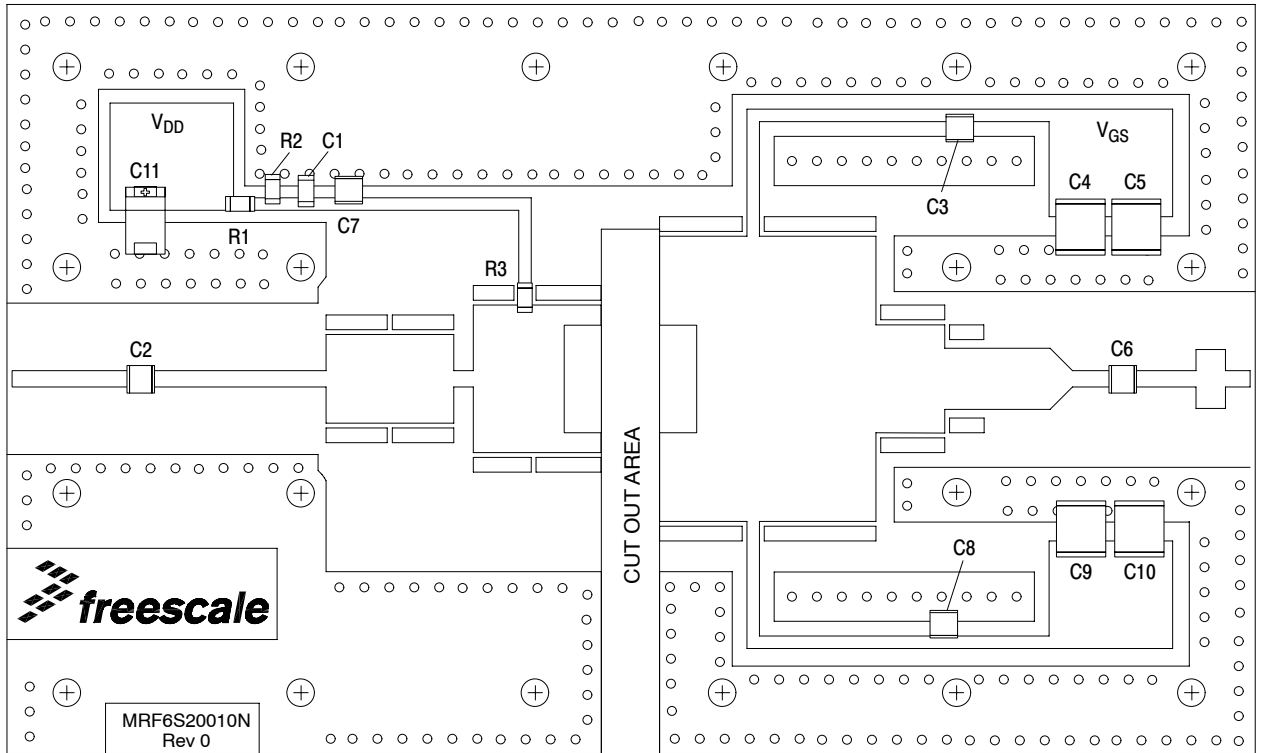


Figure 18. MRF6S20010NR1(GNR1) Test Circuit Component Layout — 1930-1990 MHz

N-CDMA TYPICAL CHARACTERISTICS — 1930-1990 MHz

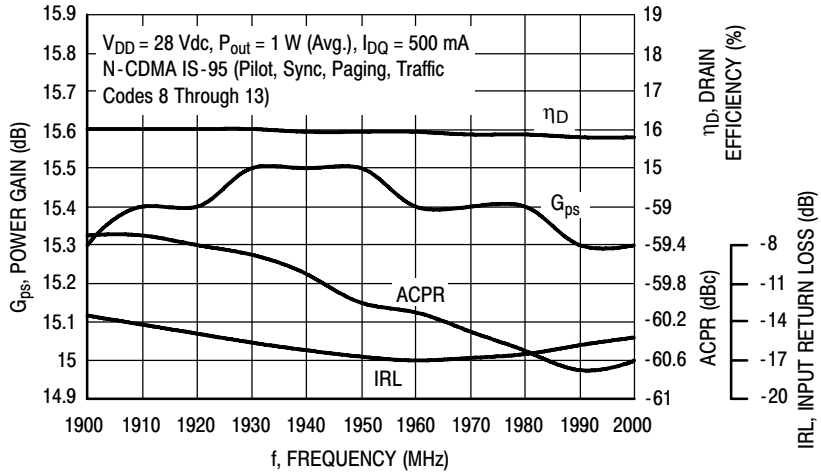


Figure 19. Single-Carrier N-CDMA Broadband Performance @ $P_{out} = 1 \text{ Watt Avg.}$

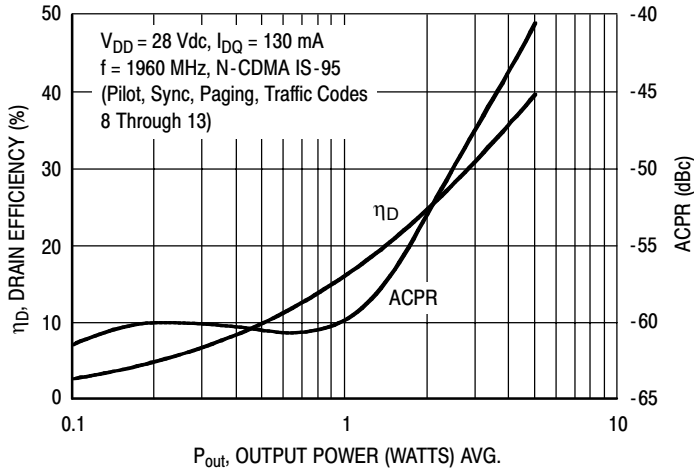


Figure 20. Single-Carrier N-CDMA ACPR and Drain Efficiency versus Output Power

N-CDMA TEST SIGNAL

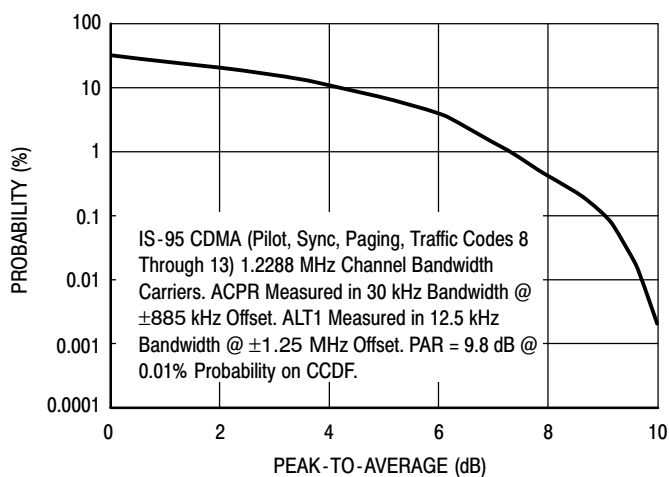


Figure 21. Single-Carrier CCDF N-CDMA

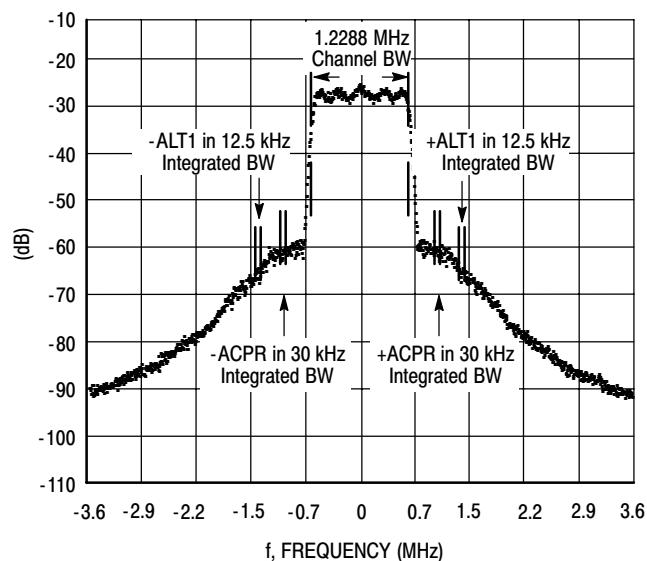


Figure 22. Single-Carrier N-CDMA Spectrum

GSM EDGE TYPICAL CHARACTERISTICS — 1805-1880 MHz

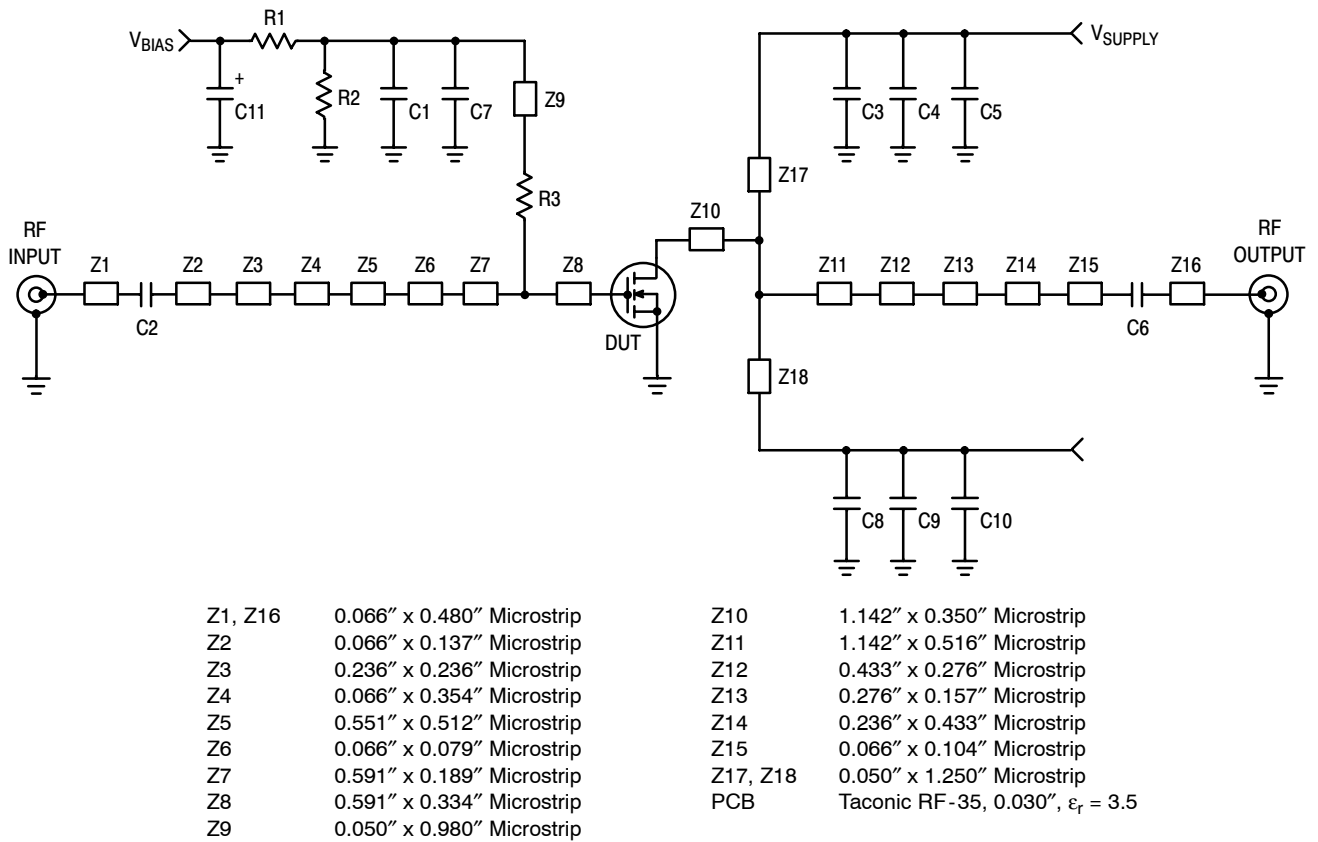


Figure 23. MRF6S20010NR1(GNR1) Test Circuit Schematic — 1805-1880 MHz

Table 8. MRF6S20010NR1(GNR1) Test Circuit Component Designations and Values — 1805-1880 MHz

Part	Description	Part Number	Manufacturer
C1	100 nF Chip Capacitor (1206)	1206C104KAT	AVX
C2, C6	4.7 pF 600B Chip Capacitors	600B4R7BW	ATC
C3, C7, C8	9.1 pF 600B Chip Capacitors	600B9R1BW	ATC
C4, C5, C9, C10	10 μ F Chip Capacitors (2220)	C5750X5R1H106MT	TDK
C11	10 μ F, 35 V Tantalum Chip Capacitor	TAJD106K035	AVX
R1, R2	10 k Ω Chip Resistors (1206)		
R3	10 Ω Chip Resistor (1206)		

GSM EDGE TYPICAL CHARACTERISTICS — 1805-1880 MHz

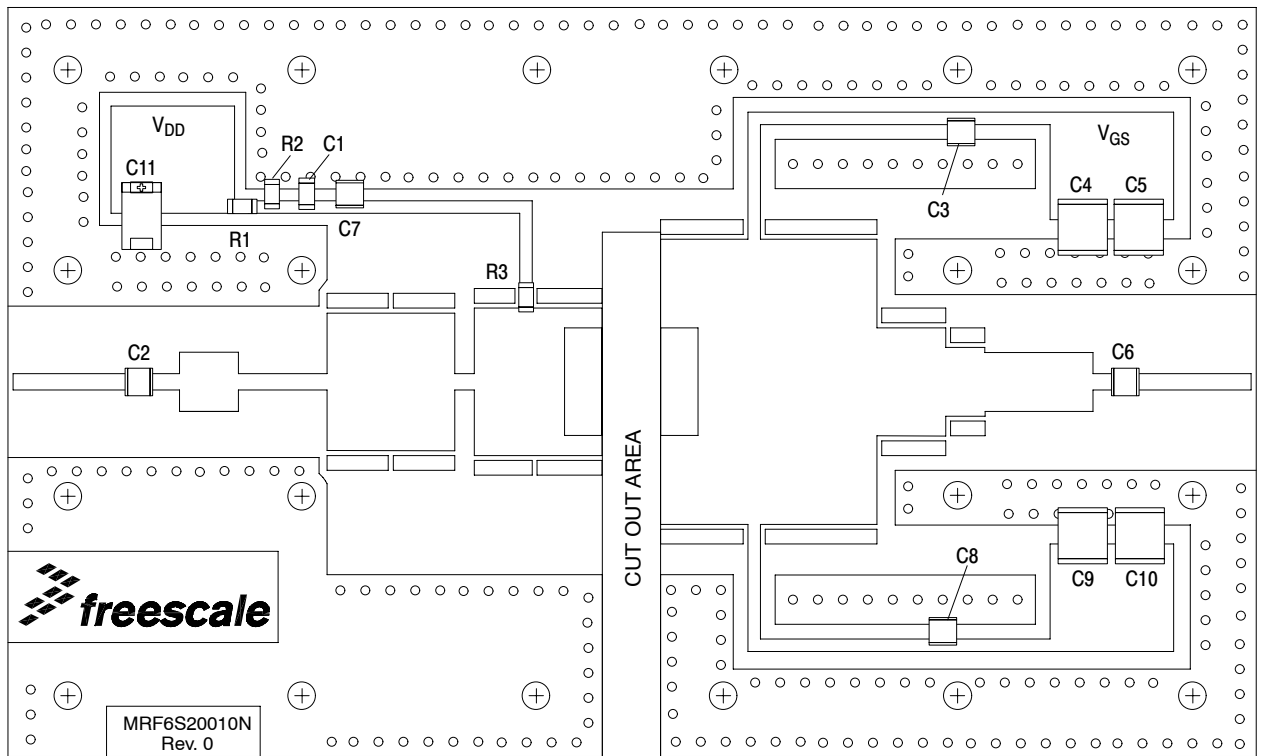


Figure 24. MRF6S20010NR1(GNR1) Test Circuit Component Layout — 1805-1880 MHz

GSM EDGE TYPICAL CHARACTERISTICS — 1805-1880 MHz

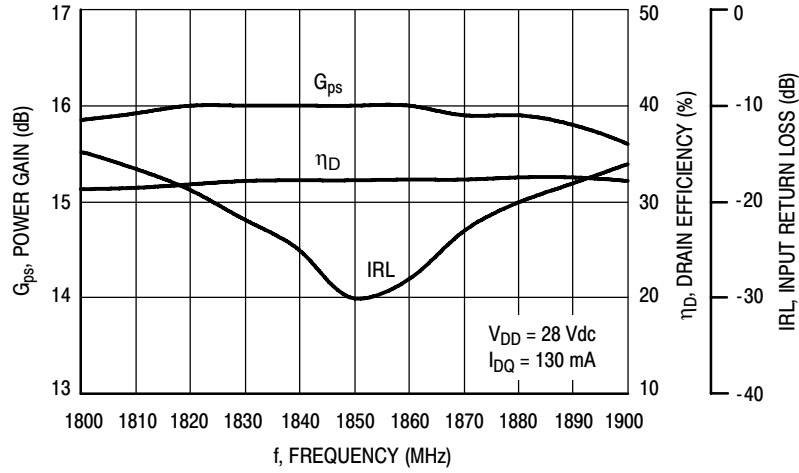


Figure 25. Power Gain, Input Return Loss and Drain Efficiency versus Frequency @ $P_{out} = 4$ Watts

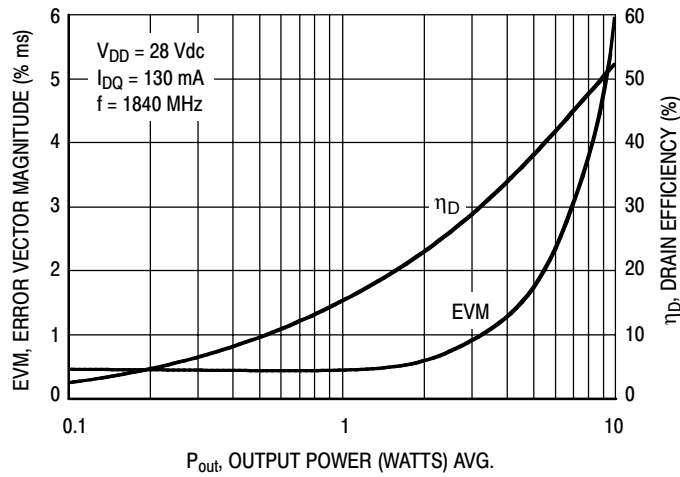


Figure 26. Error Vector Magnitude and Drain Efficiency versus Output Power

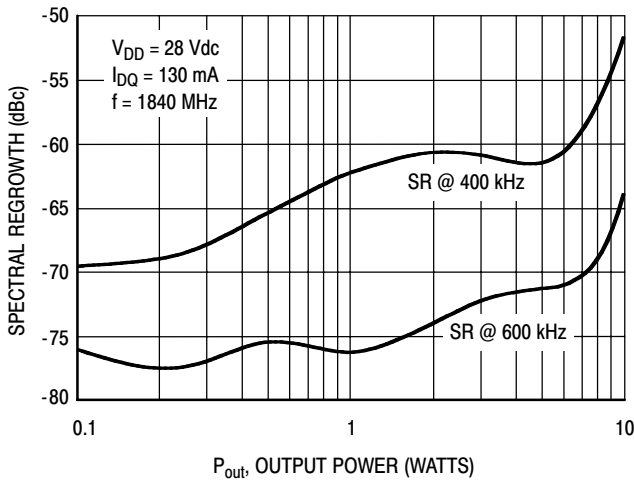


Figure 27. Spectral Regrowth at 400 kHz and 600 kHz versus Output Power

GSM EDGE TEST SIGNAL

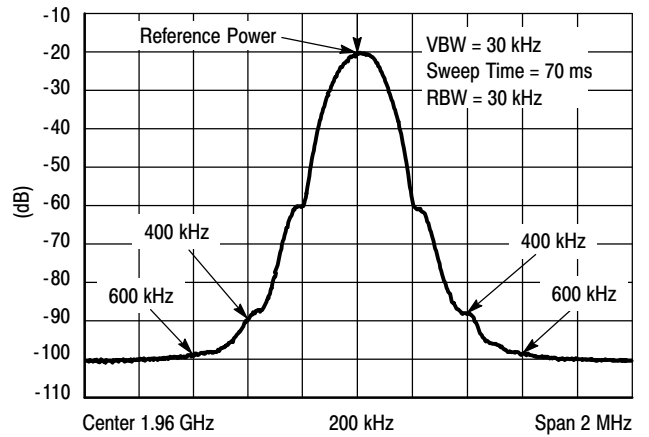
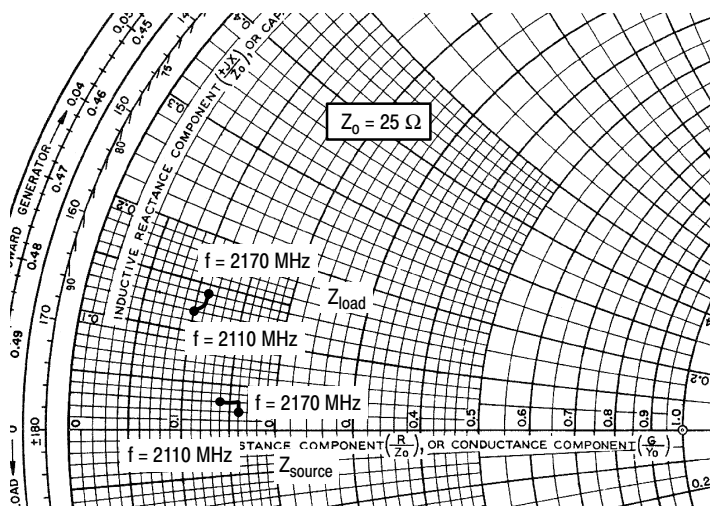


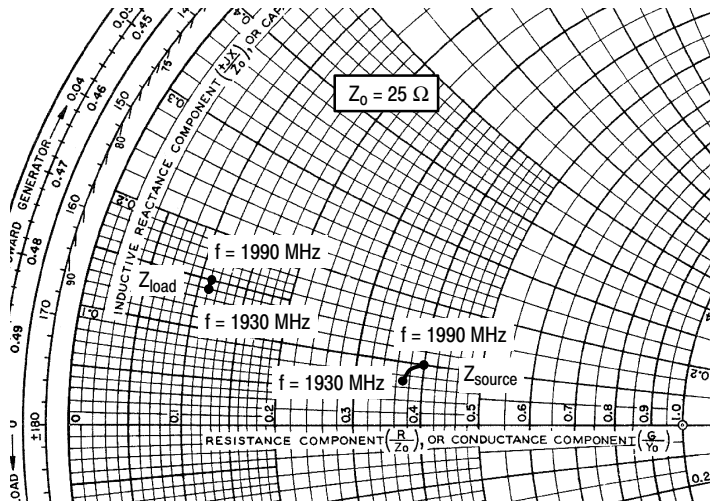
Figure 28. EDGE Spectrum



2170 MHz

$V_{DD} = 28$ Vdc, $I_{DQ} = 130$ mA, $P_{out} = 10$ W PEP

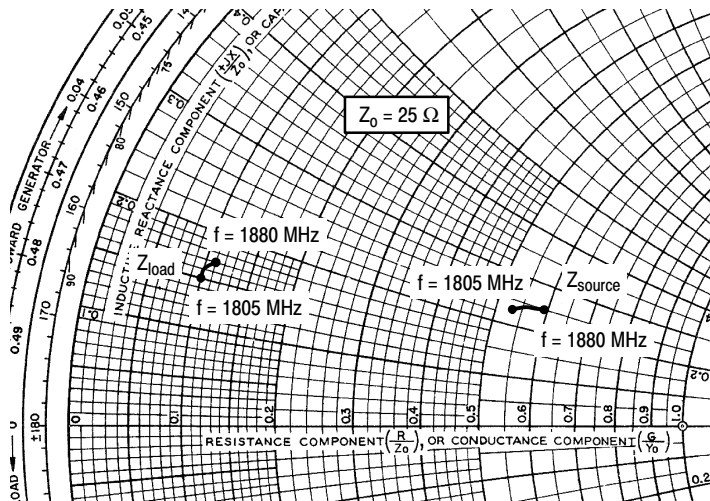
f MHz	Z_{source} Ω	Z_{load} Ω
2110	$3.619 + j0.792$	$2.544 + j3.068$
2140	$3.918 + j0.797$	$2.673 + j3.291$
2170	$4.087 + j0.558$	$2.818 + j3.406$



1900 MHz

$V_{DD} = 28$ Vdc, $I_{DQ} = 130$ mA, $P_{out} = 1$ W Avg.

f MHz	Z_{source} Ω	Z_{load} Ω
1930	$9.237 + j1.849$	$2.770 + j3.497$
1960	$9.521 + j2.144$	$2.754 + j3.668$
1990	$9.889 + j2.434$	$2.772 + j3.833$



1800 MHz

$V_{DD} = 28$ Vdc, $I_{DQ} = 130$ mA, $P_{out} = 4$ W Avg.

f MHz	Z_{source} Ω	Z_{load} Ω
1805	$13.237 + j5.810$	$2.445 + j3.698$
1840	$13.953 + j6.084$	$2.542 + j3.942$
1880	$14.858 + j6.279$	$2.695 + j4.170$

Z_{source} = Test circuit impedance as measured from gate to ground.

Z_{load} = Test circuit impedance as measured from drain to ground.

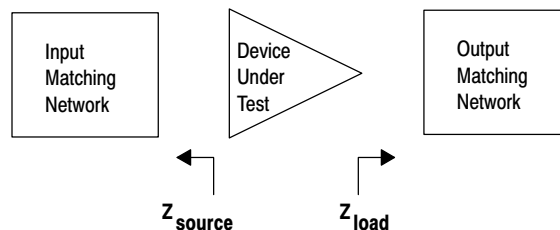


Figure 29. Series Equivalent Source and Load Impedance

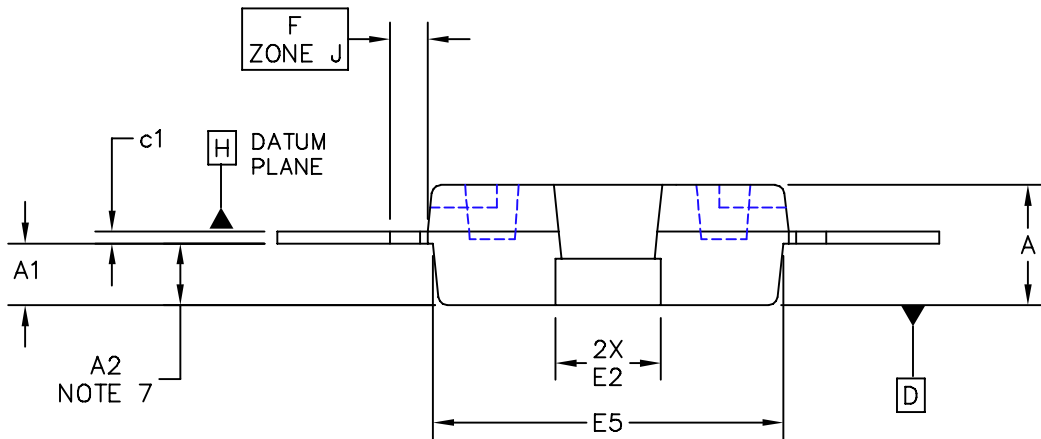
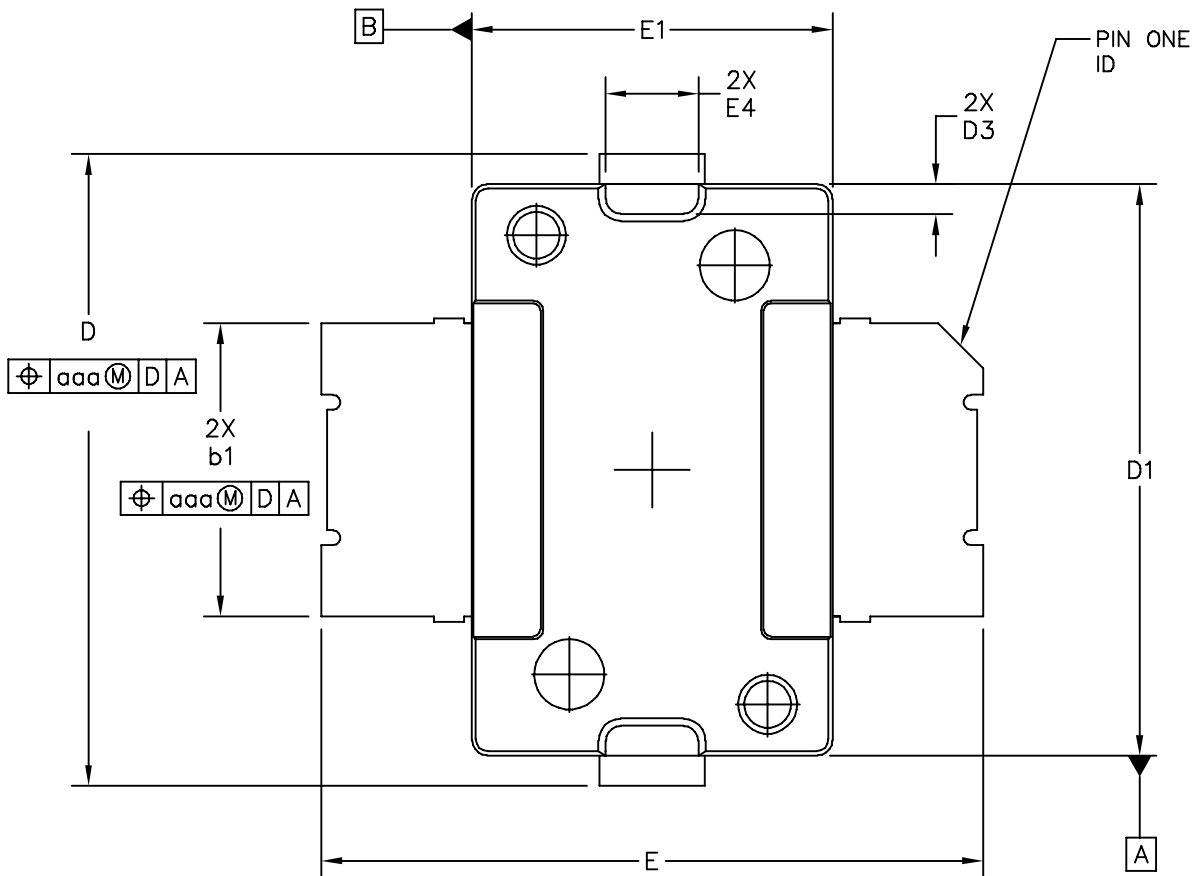
Table 9. Common Source Scattering Parameters ($V_{DD} = 28\text{ V}$, $I_{DQ} = 126\text{ mA}$, $T_C = 25^\circ\text{C}$, 50 ohm system)

f MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	S ₁₁	∠φ	S ₂₁	∠φ	S ₁₂	∠φ	S ₂₂	∠φ
500	0.984	-178.1	1.195	42.42	0.001	-129.1	0.875	-116.3
550	0.986	-179.0	0.947	40.48	0.001	-159.2	0.892	-121.6
600	0.985	179.9	0.747	39.66	0.001	147.4	0.905	-125.9
650	0.986	178.9	0.581	39.89	0.001	119.1	0.913	-129.9
700	0.982	177.9	0.446	41.80	0.001	108.1	0.927	-133.4
750	0.983	177.2	0.336	46.70	0.002	102.9	0.935	-136.4
800	0.983	176.5	0.248	56.02	0.002	96.99	0.941	-139.5
850	0.979	175.5	0.188	72.74	0.003	97.40	0.947	-141.9
900	0.980	174.8	0.168	96.69	0.003	94.63	0.951	-144.4
950	0.977	174.0	0.183	119.3	0.004	91.92	0.955	-146.6
1000	0.978	173.2	0.223	134.3	0.004	92.80	0.960	-148.6
1050	0.972	172.4	0.276	142.2	0.004	89.92	0.962	-150.5
1100	0.972	171.4	0.335	146.4	0.005	89.90	0.966	-152.2
1150	0.963	170.8	0.396	148.5	0.005	87.51	0.977	-153.7
1200	0.964	169.9	0.461	148.8	0.006	89.25	0.971	-155.2
1250	0.956	169.0	0.531	148.2	0.007	86.98	0.977	-156.8
1300	0.948	167.8	0.604	146.9	0.007	85.08	0.982	-157.9
1350	0.939	167.0	0.685	144.8	0.008	82.40	0.986	-159.5
1400	0.927	165.7	0.772	142.2	0.008	79.69	0.988	-160.7
1450	0.910	164.5	0.869	138.7	0.009	77.79	0.994	-162.1
1500	0.889	163.2	0.975	134.7	0.010	75.79	0.991	-163.4
1550	0.861	161.9	1.093	129.7	0.010	72.86	0.993	-164.7
1600	0.821	160.9	1.221	123.8	0.011	69.89	0.996	-166.0
1650	0.780	160.1	1.356	116.7	0.012	63.71	0.984	-167.4
1700	0.722	160.6	1.491	108.3	0.013	57.70	0.985	-168.5
1750	0.666	162.5	1.606	98.77	0.014	49.85	0.977	-169.6
1800	0.618	167.0	1.687	88.09	0.014	41.19	0.970	-170.8
1850	0.603	173.3	1.706	76.98	0.013	32.65	0.958	-171.3
1900	0.614	179.7	1.673	66.08	0.012	25.40	0.954	-171.9
1950	0.654	-175.6	1.591	55.96	0.011	20.73	0.945	-172.3
2000	0.701	-173.5	1.484	47.04	0.010	15.11	0.947	-172.6
2050	0.747	-172.7	1.364	39.29	0.008	10.13	0.947	-173.0
2100	0.783	-172.6	1.242	32.87	0.006	6.333	0.945	-173.6
2150	0.816	-172.9	1.136	27.69	0.004	15.63	0.944	-173.9
2200	0.842	-173.6	1.042	23.26	0.004	42.20	0.944	-174.2
2250	0.864	-174.2	0.961	19.26	0.005	57.76	0.948	-174.6
2300	0.882	-175.0	0.888	15.75	0.006	62.56	0.948	-175.2
2350	0.894	-175.7	0.822	12.69	0.008	59.72	0.949	-175.7
2400	0.906	-176.4	0.764	9.857	0.009	49.09	0.951	-176.1
2450	0.910	-176.9	0.712	7.587	0.008	39.24	0.955	-176.5

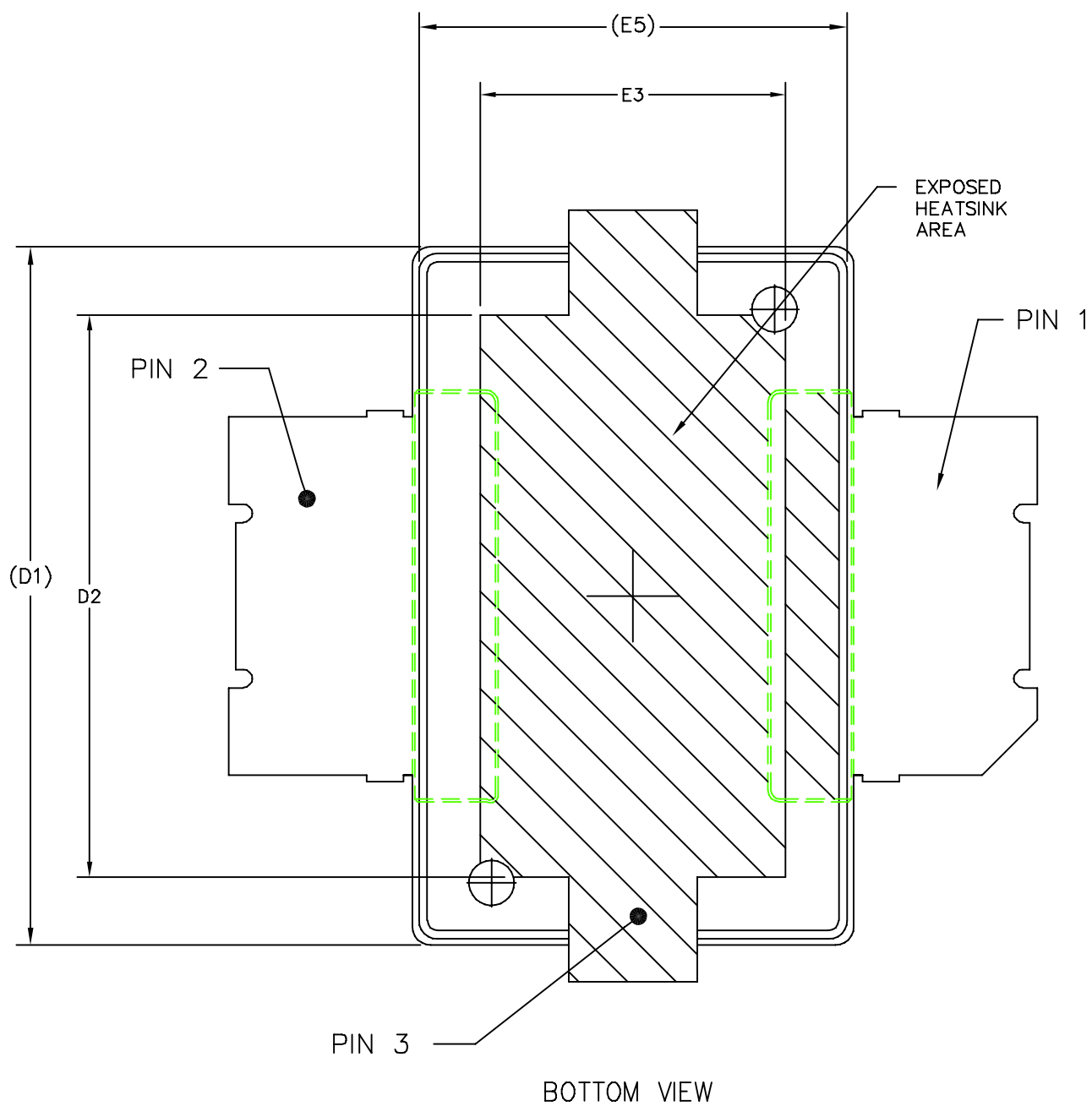
Table 9. Common Source Scattering Parameters ($V_{DD} = 28\text{ V}$, $I_{DQ} = 126\text{ mA}$, $T_C = 25^\circ\text{C}$, 50 ohm system) (continued)

f MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	S ₁₁	∠ φ	S ₂₁	∠ φ	S ₁₂	∠ φ	S ₂₂	∠ φ
2500	0.923	-177.5	0.666	5.462	0.006	42.56	0.957	-177.2
2550	0.927	-178.0	0.625	3.680	0.006	52.25	0.962	-177.8
2600	0.937	-178.8	0.591	1.864	0.006	60.26	0.961	-178.4
2650	0.937	-179.0	0.559	0.237	0.007	64.14	0.964	-179.1
2700	0.942	-179.8	0.529	-1.378	0.007	65.62	0.964	-179.6
2750	0.945	-179.9	0.504	-2.768	0.007	64.71	0.964	179.7
2800	0.946	179.5	0.479	-4.088	0.007	67.58	0.966	179.4
2850	0.950	179.3	0.456	-5.412	0.007	75.44	0.966	178.8
2900	0.949	178.8	0.436	-6.305	0.008	82.04	0.964	178.3
2950	0.952	178.5	0.419	-7.279	0.009	83.60	0.967	177.9
3000	0.950	178.4	0.402	-8.087	0.011	83.41	0.968	177.4
3050	0.958	177.9	0.387	-9.138	0.012	81.35	0.964	176.8
3100	0.953	177.7	0.373	-9.904	0.013	77.45	0.969	176.4
3150	0.957	177.2	0.362	-10.86	0.014	70.98	0.970	176.2
3200	0.960	177.4	0.350	-11.79	0.013	67.00	0.970	175.5

PACKAGE DIMENSIONS



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TITLE: TO-270 SURFACE MOUNT	DOCUMENT NO: 98ASH98117A	REV: J	
	CASE NUMBER: 1265-08	01 APR 2005	
	STANDARD: NON-JEDEC		



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TITLE: <div style="text-align: center; padding: 5px;"> TO-270 SURFACE MOUNT </div>	DOCUMENT NO: 98ASH98117A	REV: J	
	CASE NUMBER: 1265-08	01 APR 2005	
	STANDARD: NON-JEDEC		

MRF6S20010NR1 MRF6S20010GNR1

NOTES:

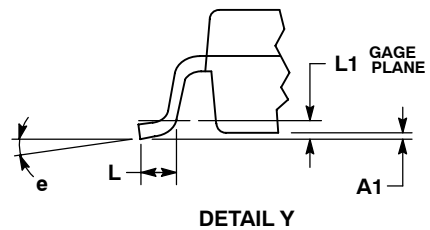
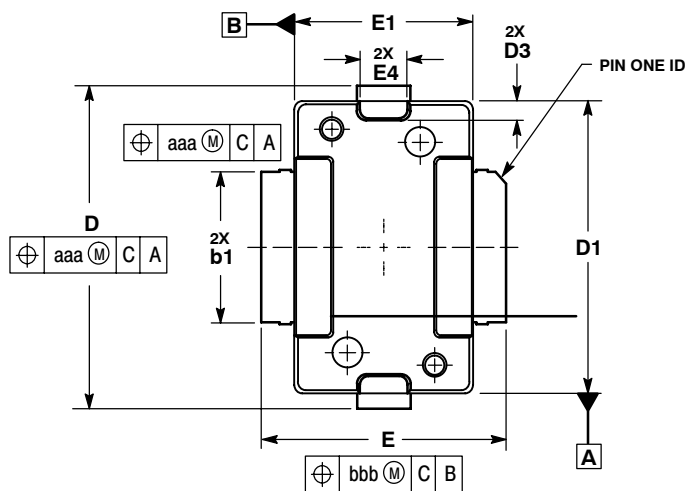
1. CONTROLLING DIMENSION: INCH
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
3. DATUM PLANE -H- IS LOCATED AT TOP OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE TOP OF THE PARTING LINE.
4. DIMENSIONS "D1" AND "E1" DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .006 PER SIDE. DIMENSIONS "D1" AND "E1" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -H-.
5. DIMENSION "b1" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .005 TOTAL IN EXCESS OF THE "b1" DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. DATUMS -A- AND -B- TO BE DETERMINED AT DATUM PLANE -H-.
7. DIMENSION "A2" APPLIES WITHIN ZONE "J" ONLY.
8. DIMENSIONS "D" AND "E2" DO NOT INCLUDE MOLD PROTRUSION. OVERALL LENGTH INCLUDING MOLD PROTRUSION SHOULD NOT EXCEED 0.430 INCH FOR DIMENSION "D" AND 0.080 INCH FOR DIMENSION "E2". DIMENSIONS "D" AND "E2" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -D-.

STYLE 1:

- PIN 1 - DRAIN
- PIN 2 - GATE
- PIN 3 - SOURCE

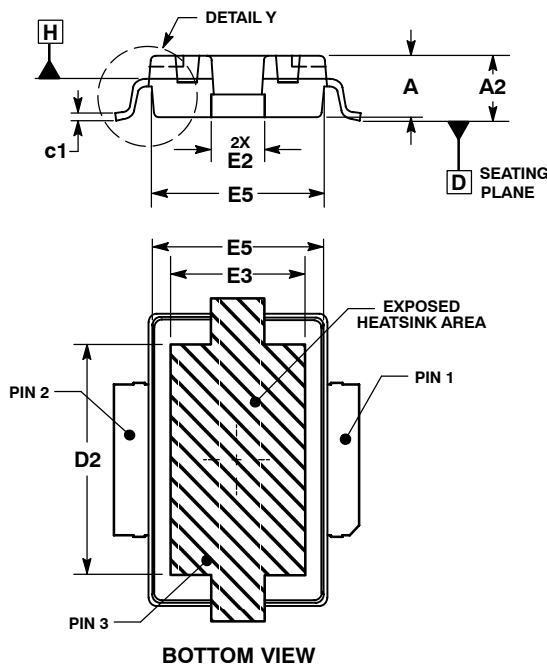
DIM	INCH		MILLIMETER		DIM	INCH		MILLIMETER	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	MAX
A	.078	.082	1.98	2.08	F	.025 BSC		0.64 BSC	
A1	.039	.043	0.99	1.09	b1	.193	.199	4.90	5.06
A2	.040	.042	1.02	1.07	c1	.007	.011	0.18	0.28
D	.416	.424	10.57	10.77	aaa	.004		0.10	
D1	.378	.382	9.60	9.70					
D2	.290	.320	7.37	8.13					
D3	.016	.024	0.41	0.61					
E	.436	.444	11.07	11.28					
E1	.238	.242	6.04	6.15					
E2	.066	.074	1.68	1.88					
E3	.150	.180	3.81	4.57					
E4	.058	.066	1.47	1.68					
E5	.231	.235	5.87	5.97					

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TITLE: TO-270 SURFACE MOUNT		DOCUMENT NO: 98ASH98117A		REV: J	
		CASE NUMBER: 1265-08		01 APR 2005	
		STANDARD: NON-JEDEC			



NOTES:

1. CONTROLLING DIMENSION: INCH.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
3. DATUM PLANE -H- IS LOCATED AT TOP OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE TOP OF THE PARTING LINE.
4. DIMENSIONS "D1" AND "E1" DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .006 PER SIDE. DIMENSIONS "D1" AND "E1" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -H-.
5. DIMENSION b1 DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .005 TOTAL IN EXCESS OF THE b1 DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. DATUMS -A- AND -B- TO BE DETERMINED AT DATUM PLANE -H-.
7. DIMENSIONS "D" AND "E2" DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .003 PER SIDE. DIMENSIONS "D" AND "E2" DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -D-.



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.078	.082	1.98	2.08
A1	.001	.004	0.02	0.10
A2	.077	.088	1.96	2.24
D	.416	.424	10.57	10.77
D1	.378	.382	9.60	9.70
D2	.290	.320	7.37	8.13
D3	.016	.024	0.41	0.61
E	.316	.324	8.03	8.23
E1	.238	.242	6.04	6.15
E2	.066	.074	1.68	1.88
E3	.150	.180	3.81	4.57
E4	.058	.066	1.47	1.68
E5	.231	.235	5.87	5.97
L	.018	.024	4.90	5.06
L1	.01 BSC		0.25 BSC	
b1	.193	.199	4.90	5.06
c1	.007	.011	0.18	0.28
e	2°	8°	2°	8°
aaa	.004		0.10	

STYLE 1:
 PIN 1. DRAIN
 2. GATE
 3. SOURCE

**CASE 1265A-02
 ISSUE B
 TO-270-2 GULL
 PLASTIC
 MRF6S20010GNR1**

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Technical Information Center, CH370
1300 N. Alma School Road
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+1-800-521-6274 or +1-480-768-2130
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Europe, Middle East, and Africa:

Freescale Halbleiter Deutschland GmbH
Technical Information Center
Schatzbogen 7
81829 Muenchen, Germany
+44 1296 380 456 (English)
+46 8 52200080 (English)
+49 89 92103 559 (German)
+33 1 69 35 48 48 (French)
support@freescale.com

Japan:

Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku,
Tokyo 153-0064
Japan
0120 191014 or +81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:

Freescale Semiconductor Hong Kong Ltd.
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